(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 691 109 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
10.01.1996 Bulletin 1996/02

(51) Int. Cl.[6]: **A61F 2/16**

(21) Application number: **95110434.8**

(22) Date of filing: **04.07.1995**

(84) Designated Contracting States:
CH DE FR GB LI SE

(30) Priority: **04.07.1994 JP 174799/94**

(71) Applicant: **Suzuki, Taketoshi**
Mizusawa-shi, Iwate-ken (JP)

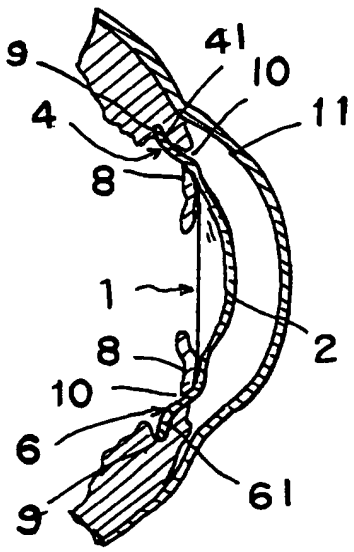
(72) Inventor: **Suzuki, Taketoshi**
Mizusawa-shi, Iwate-ken (JP)

(74) Representative: **Schaumburg, Thoenes & Thurn**
D-81634 München (DE)

(54) Intraocular lens

(57) An intraocular lens (1) to be implanted in an anterior chamber (7) comprises a disk-shaped lens body (2) and a plurality of support legs (3, 4, 5, 6) extending in two opposite directions. The support legs (3, 4, 5, 6) are long enough for their distal ends (31, 41, 51, 61) to engagingly sit in ciliary sulci (9) when the support legs (3, 4, 5, 6) are inserted in and through fine bores or apertures 10 made by incision in a peripheral site of an iris (8).

FIG. 4



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Description

BACKGROUND OF THE INVENTION

Field of the Invention

This invention relates to an intraocular lens and more particularly to an intraocular lens to be implanted in the anterior chamber of an eye.

Description of the Related Art

Intraocular lenses have been used for years for implantation after surgery such as extracapsular cataract extraction, ultrasonic emulsifying aspiration, and so on. Most typical intraocular lenses are those to be implanted within lens capsules in posterior chambers (hereinafter called posterior chamber lenses). However, there are some particular conditions of surgery which make it impossible to fix the intraocular lens in the posterior chamber. In such cases, the intraocular lens, when placed in the posterior chamber, must be sutured to the ciliary sulcus; otherwise, it is placed in the anterior chamber.

Suturing an intraocular lens to a ciliary sulcus is a very difficult technique which requires a high skill, and needs an expensive equipment for removal of a front part of the vitreous body. Moreover, since this method makes necessary a large surgical intervention, it may cause trouble in the oculus, or other troubles which are currently unknown but may possibly be realized after many years.

In contrast, implantation of an intraocular lens in the anterior chamber requires neither a high skill nor an expensive equipment. However, intraocular lenses so far available for placement in the anterior chamber (hereinafter called anterior chamber lenses) were designed to be fixed by engagement with the anterior chamber angle. Therefore, these anterior chamber lenses were liable to damage a wide area of the anterior chamber angle. Moreover, internal support of conventional anterior chamber lenses was unreliable and could not prevent their rotating or other motional displacement. These could be large factors of inflammation or others like troubles of the corneal endothelium which might further invite damage to the iris after surgery.

OBJECT OF THE INVENTION

It is therefore an object of the present invention to provide an intraocular lens to be implanted in an anterior chamber, easy to support therein, reliably fixed in place, and remarkably safe without damaging the tissues around it.

SUMMARY OF THE INVENTION

According to the invention, there is provided an intraocular lens comprising a lens body and elongated extensions extending from an outer circumferential margin of the lens body, the elongated extensions being long enough for their distal ends to engagingly sit in grooves of a ciliary body, i.e. ciliary sulci, when the elongated extensions are inserted into and beyond fine apertures made by incision in a peripheral site of an iris.

The intraocular lens according to the invention, when used, is fixed in an anterior chamber by placing the lens body in the anterior chamber and by simultaneously inserting the elongated extensions into fine apertures made by incision in the peripheral site of the iris. Then the distal ends of the elongated extensions go beyond the fine apertures and engagingly sit in in the ciliary sulci. As a result, the lens body is fixed stationary in place in the anterior chamber. Fine apertures can be made so small that they do not disturb the movement of the iris.

The foregoing and other objects, features and advantages of the invention will become more apparent in the light of the following description of a preferred embodiment thereof, as illustrated in the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a front elevation of an intraocular lens taken as a preferred embodiment of the invention;
Fig. 2 is a side elevation of the same intraocular lens;
Fig. 3 is a plan view of a lens glide used for making through bores or apertures in a peripheral site of an iris; and
Fig. 4 is a diagram showing how the intraocular lens is fixed in place of an eye.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

As best shown in Fig. 1, an intraocular lens 1 taken as a preferred embodiment of the invention generally comprises a disk-shaped lens body 2 acting as the optical portion of the lens 1, and four support legs or extensions 3 to 6 extending from the lens body 2 to act as support members.

The lens body 2 has a diameter of about 6 mm as large as conventional anterior chamber lenses, and is made of polymethyl methacrylate or any other appropriate material so far approved for use as intraocular lenses.

The support legs 3 to 6 are made of polymethyl methacrylate or other stable material having an appropriate resiliency and hardness like those used for making support legs of conventional intraocular lenses to be placed in anterior chambers. Each of the support legs 3 to 6 is an elongated element having a diameter of about 0.2 mm, for example.

Two of the support legs, 3 and 4, are opposed face to face with each other and extend in a first direction, i.e. upwardly in Figs. 1 and 2. The other support legs, 5 and 6, are also opposed face to face with each other but extend in a second direction opposite from the first direction, i.e. downwardly in Figs. 1 and 2.

The support legs 3 to 6 moderately curve backwardly, as best shown in Fig. 2, such that they can engage with ciliary sulci after penetrating a peripheral site 8 of an iris when the lens 1 is inserted in an anterior chamber 7. Moreover, distal ends of the support legs 3 to 6 are bent to form engaging portions 31, 32, 33 and 34.

Two of the support legs, 3 and 4, extending upwardly, make a first pair, while the other support legs 5 and 6, extending downwardly, make a second pair. As best shown in Fig. 1, the support legs in each pair curve to gradually diminish their relative distance. Then, their engaging portions, 31 and 41, 51 and 61, are bent back outwardly, to exhibit an approximately semicircular arc.

When using the intraocular lens according to the embodiment, after surgery such as extracapsular cataract extraction and ultrasonic emulsifying aspiration, or after surgery such as intracapsular cataract extraction, fine through bores or apertures 10 as small as 0.5 to 1 mm, for example, are formed in a peripheral site of the iris 8 via the cornea 11 so that the support legs 3, 4, 5 and 6 can pass through the fine apertures 10.

A lens glide plate 12 as shown in Fig. 3 will assist the operation for making the fine apertures 10 at precise positions.

The lens glide plate 12 is a plate-shaped member having guide grooves 13, 14, 15 and 16 along its opposite side edges 121 and 122. Relative distances and locations of the guide grooves 13 to 16 correspond to those of the support legs 3 to 6 of the intraocular lens 1.

The lens glide 12, when used, is placed on the cornea 11. Then a fine cutter is fit to the guide grooves 13 to 16 and pierced through the cornea 11 into the peripheral site of the iris 8. Thus the desired small apertures 10 are formed at proper positions of the iris 8 (not illustrated in detail).

The use of the lens glide plate 12 also serves to prevent that the vitreous creeps over the intraocular lens 1 when the lens 1 is inserted in the chamber.

After the foregoing preparation, while the lens body 2 is inserted in the anterior chamber 7, the support legs 3 to 6 are inserted into the respective apertures 10 in the iris 8 until the engaging portions 13 to 16 at their distal ends go beyond the iris 8 and engagingly sit in the ciliary sulci 9. Thus the intraocular lens 1 is reliably fixed in the anterior chamber 7.

As apparent from the explanation so far made, the intraocular lens 1 according to the embodiment can be inserted very easily, and is reliably fixed in position by engagement of its support legs 3 to 6 with the ciliary sulci through fine bores or apertures 10 in the peripheral site of the iris 8, which may be so small that they do not disturb the motion of the iris. Therefore, this intraocular lens 1 removes the possibility of any trouble in the corneal endothelium after surgery.

The use of four support legs 3 to 6 in the above-described embodiment is more advantageous for preventing a rotational motion of the intraocular lens 1 in the anterior chamber 7 and to eliminate the possibility of damaging the iris 8 and the cornea 10 after surgery. However, substantially the same effect is expected also when the total number of support legs is three, namely, one support leg extending in the first direction (upward) and two legs extending in the second direction (downward), or vice versa.

As described above, the intraocular lens according to the invention is an anterior chamber lens for implantation in the anterior chamber, which needs neither a high skill having been required for conventional posterior chamber lenses for placement in the posterior chamber to suture them to ciliary sulci, nor an expensive apparatus for removal of the vitreous which was also required for conventional posterior chamber lenses. Moreover, unlike the conventional anterior chamber lenses, the intraocular lens according to the invention does not cause any trouble in the cornea even after a long use after surgery, because of its reliable fixture in the anterior chamber by reliable and unharmful engagement of its support legs with ciliary sulci.

The fact that the vitreous does not need to be removed not only ensures safe implantation of the intraocular lens but also contributes to reducing the time required for surgery.

Moreover, unlike the conventional anterior chamber lenses fixed by engagement of their support legs with the anterior chamber angle, the intraocular lens according to the invention is held in position by engagement of its support legs with ciliary sulci through fine bores or apertures made in a peripheral site of the iris where the desired motion of the iris is not disturbed. Therefore, the intraocular lens is held in a remarkably stable condition, and removes the possibility of damages to the iris and the corneal endothelium caused by rotation or other motional displacement of the lens after surgery.

In particular, when using four support legs making two pairs extending in opposite directions, the intraocular lens is more reliably fixed in position.

The intraocular lens according to the invention has a relatively simple structure, although having support legs extending from the lens body, which is not unreasonably complex as compared to conventional intraocular lenses for placement in the anterior chamber Therefore, it can be fabricated easily while ensuring sufficient durability.

Although the invention has been shown and described with respect to preferred embodiments thereof, it should be understood by those skilled in the art that the foregoing and other changes and omissions in the form and detail thereof may be made therein without departing from the spirit and scope of the invention, which is to be limited and defined only as set forth in the following claims.

Claims

1. An intraocular lens to be implanted in an anterior chamber, comprising:
   a lens body; and
   elongated extensions extending from said

lens body which are long enough for their distal ends to engagingly sit in ciliary sulci when said elongated extensions are inserted in and through fine apertures made in a peripheral site of an iris.

2. The intraocular lens according to claim 1 wherein the number of said elongated extensions are at least three, one or more of said elongated extensions extending in a first direction, and the other or others of said elongated extensions extending in a second direction opposite from said first direction.

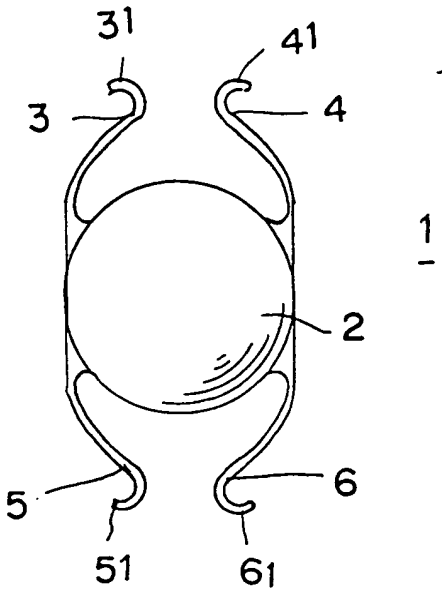

FIG. 1

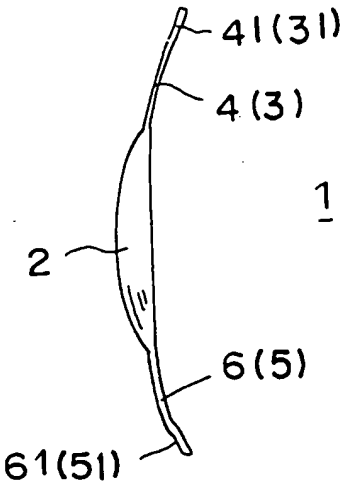

FIG. 2

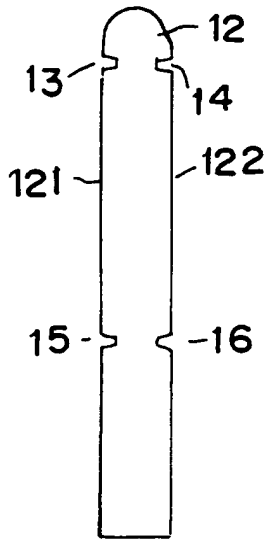

FIG. 3

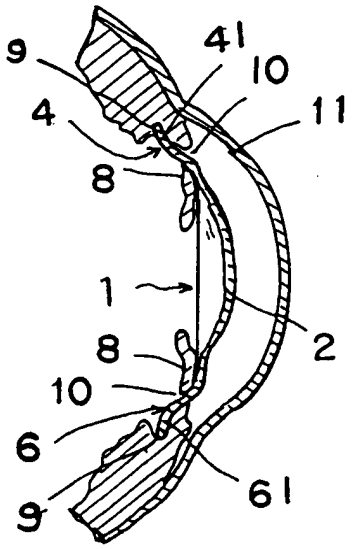

FIG. 4

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 95 11 0434

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
Y A	US-A-3 986 214 (KRASNOV) * claim 3; figures 5-7,12-15 *	1 2	A61F2/16
Y	US-A-4 242 760 (RAININ) * column 5, line 50 - line 52; figure 7 *	1	
A	US-A-4 262 370 (HARTSTEIN) * abstract; figures 1-3 *	1	
A	WO-A-86 01096 (KIEVSKY NAUCHNO-ISSLEDOVATELSKY INSTITUT KLINICHESKOI ETC.) * abstract; figures 1,5 *	1,2	
A	US-A-4 127 903 (SCHACHAR) * abstract; figures *	1	
A	US-A-4 504 981 (WALMAN) * abstract; figures 8,12 *	1	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

A61F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	26 September 1995	Kanal, P

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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